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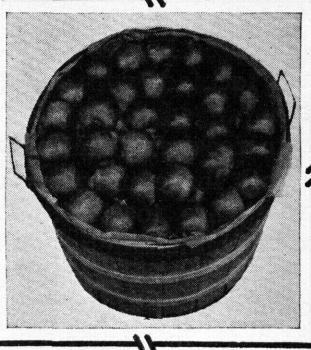
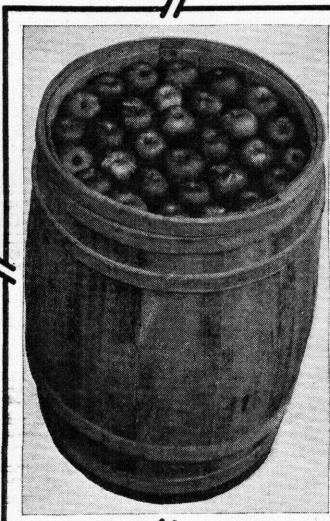
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U. S. Department of Agriculture

# U. S. DEPARTMENT OF AGRICULTURE

FARMERS' BULLETIN No. 1695

## PREPARING APPLES FOR MARKET *in BARRELS* *and BASKETS*



**G**RADING AND ATTRACTIVENESS of the pack are important factors in determining the prices growers receive for their apples. The barrel is used as a container for apples in the eastern and central parts of the United States. The bushel basket is used in these regions and is also used extensively in Colorado, Idaho, and Utah. Use of the bushel basket, particularly the straight-sided type, has increased. Machines of various types are largely used for sizing the apples, which are graded by hand as they move on canvas or roller conveyors toward the sizing device.

Official standards for apples packed in barrels and baskets have been issued by the United States Department of Agriculture, and Federal-State inspection service is available in important commercial producing districts. Federal inspection service is available at important markets. Standards and inspection services are widely used.

Barrels and baskets should be well faced and well filled to insure a tight pack. Barrels must be properly headed to avoid unnecessary bruising of the contents. Various devices are used in packing the baskets. Shredded oiled paper should be distributed among the apples intended for storage, as they are packed, to prevent or reduce damage from scald. Containers should be plainly marked with descriptions of their contents.

Packing houses should be conveniently and properly located, with adequate lighting facilities, and so arranged that fruit passes directly through them from receiving platform to loading space.

Both loose and packed fruit must be handled with great care to avoid bruising. If not to be marketed immediately, packed fruit should be placed in cold storage promptly. Car-lot shipments should be so loaded as to prevent damage through shifting of packages in transit.

This bulletin is a revision of, and supersedes, Farmers' Bulletin 1080, Preparation of Barreled Apples for Market.

# PREPARING APPLES FOR MARKET IN BARRELS AND BASKETS<sup>1</sup>

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## CHANGING CONDITIONS

A MOVEMENT TOWARD concentrating the apple industry in the more favorable locations and eliminating many farm orchards has been taking place since 1912. This has been particularly true in some parts of the barrel-and-basket apple region, and should facilitate the use of better methods and equipment in preparing apples for market.

In the eastern and central parts of the United States apples are usually packed in barrels or bushel baskets. In Colorado, Idaho, and Utah, the barrel is not used, but the basket is used extensively. This territory comprises the barrel-and-basket region and during the period 1927 to 1931 it annually produced more than half of the commercial apple crop of the United States. The average for the 5-year period was 61 per cent. Since 1922 an increasing proportion of apples have been packed in bushel baskets.

The competition from a large tonnage of carefully graded boxed apples has resulted in a more exacting market and has emphasized the importance of the closest study of the details of operation and equipment in marketing apples packed in barrels and bushel baskets. Well-chosen equipment, up-to-date methods, and careful supervision of crews are necessary to insure a well-graded and attractive product, and lowered costs are necessary to meet competition.

## HARVESTING

Much fruit reaching the markets each season is greatly impaired in quality by being picked at the wrong stage of maturity—either too

<sup>1</sup> This bulletin is based in large part upon Farmers' Bulletin No. 1080, Preparation of Barreled Apples for Market, by W. M. Scott, H. C. Hetzel, H. W. Samson, and M. Stockton, formerly of the Bureau of Agricultural Economics.

early or too late for best results. This mistake may be made because of failure to understand when the fruit should be picked, failure to interpret correctly under field conditions the factors that indicate the proper stage of maturity, or because such factors as available labor and weather conditions make it difficult to pick the fruit at the proper stage.

#### TIME OF PICKING

Varietal characteristics, seasonal variations, cultural practices, and other factors affect the maturity of apples. The three of greatest importance in determining when to pick the fruit are: (1) The degree of yellowing in the unblushed or uncolored portion of the fruit; (2) the firmness of the flesh of the fruit, which can be accurately measured by pressure-test apparatus; and (3) the way the fruit is holding to the tree or the ease with which it may be picked. For the details of these maturity tests and for statements of the proper time to pick a number of important commercial varieties, growers should consult Department Bulletin 1448 of the United States Department of Agriculture.

Certain other indications of ripeness, such as degree of red color and color of the seeds, have been used to some extent. Most normally colored fruit of red or striped varieties is ready to harvest if it has attained the proper size and if it separates readily from the spurs. For yellow, green, and russet varieties the size of the fruit together with ease of separating the stems from the spurs is frequently used as a maturity test. Fruit is usually not ready if it clings to the spurs so tightly that the stems are pulled out or the spurs are broken.

Red color is not always a reliable index of maturity, as the degree of color varies with the season, the size of the crop, the vigor and age of the tree, soil conditions, and other factors. Frequently, in an attempt to obtain good color, a crop of pale fruit is allowed to hang so long that it is overripe when harvested. The degree of yellowing in the unblushed portion of the fruit is considered a better criterion of maturity than is the degree of red coloration. Brown color of seeds is not a reliable index of maturity, as colored seeds are often found in immature fruit, but it is certain that the fruit is not ready to pick before the seeds turn brown. No one test is considered entirely reliable as an indicator of the best time for picking.

Fruit harvested when immature is inclined to scald in storage and, in extreme cases, may shrivel. Its quality and flavor may be impaired. On the other hand, if it is allowed to become overripe on the trees it will not keep so long in storage. To get the best results in storage and in the markets, each variety should be considered separately.

Maturity is not so important in the case of summer varieties of apples not intended for storage. The larger apples of summer varieties are sometimes picked for cooking as soon as they are large enough to meet the demands of the market.

#### NUMBER OF PICKINGS

Most growers remove all the fruit from the trees at one picking, although some make two or more pickings during the season. The advisability of making more than one picking depends upon a num-

ber of factors. The extent to which the color and size of the fruit is affected by the load on the trees is one. If trees are heavily loaded it may be advisable to pick the apples on the outside of the trees, especially the larger and better colored specimens, permitting the limbs to lift and expose the poorly colored fruit to the sun. Such thinning also tends to bring about an increase in the size of the fruit that remains on the trees. Other factors that influence the advisability of making one or more pickings are: Amount and cost of available labor, market conditions, average quality of the crop, weather conditions, and length of time before frost is likely to occur.

The second picking is usually made within a week or 10 days after the first. Two pickings are more expensive than one because of the additional time required, though the increase in the market value of the crop may justify them.

#### METHOD OF PICKING

When picking apples the stems should be separated from the spurs either by giving the fruit a slight rotating motion combined with a sharp upward twist or by exerting a slight pressure with the thumb or forefinger at the joint of the stem and spur, just as the fruit is pulled. The stem should not be torn out, as apples that have been skin-broken in this way are more subject to decay in storage.

If twigs or spurs are pulled off with the fruit they are likely to cause stem punctures during hauling and packing, and since fruit is borne on the same spurs year after year, subsequent crops may be reduced. Some varieties lose their spurs very readily even when the pickers use reasonable care, but growers should insist that these spurs be removed before the fruit is placed in the picking receptacles even if the speed of the work be reduced. Satisfactory results require that the work of each picker be inspected from time to time by the grower or a competent foreman.

#### PICKING UTENSILS

Drop-bottom buckets, canvas sacks, and round half-bushel baskets are the most common apple-picking receptacles. The use of drop-bottom buckets has increased rapidly. Hamper baskets are used extensively as picking utensils in the apple sections of Delaware and New Jersey.

The rigid sides of the drop-bottom bucket protect the fruit from being bruised when the picker presses the bucket against a ladder or a limb. The canvas drop bottom is in the form of a tube and can be folded or pulled up and fastened so as to close the opening while the bucket is being filled. The canvas protects the apples when they are dropped on the bottom of the bucket, and enables the picker to transfer the contents to a field box or basket without bruising. The rim of the bucket should be well padded and the bucket should be equipped with canvas straps so that it can be attached comfortably to the picker's shoulders, permitting the use of both hands in picking. (Fig. 1.) It is desirable to have the picking bucket somewhat flattened on one side, to fit against the picker's body. In one type of drop-bottom bucket the circumference at the bottom is slightly greater than that at the top. It is claimed that this reduces bruising injury when the bucket is emptied.

Picking sacks differ widely in design and in material. The drop-bottom canvas sacks (fig. 2) holding about one-half bushel are equipped with straps that hold them securely in front of the body as the picker works. The sack is a canvas tube held open at the top by a wire frame. On the bottom of the tube is a snap or rings with which the sack may be closed by folding up the tube and attaching it to a ring or hooks on the front.

These sacks, like drop-bottom buckets, are more convenient than baskets because they are so held in place that pickers have free use of both hands. Their chief disadvantage is the greater possibility of bruising the fruit because their sides are flexible.

Round picking baskets holding approximately one-half bushel, used in all the eastern apple-growing districts, usually are made from staves, and equipped with wire bails or wooden handles. The rigid

FIGURE 1.—The rigid sides and padded rim of this drop-bottom picking bucket protect the fruit from being bruised

sides of these baskets protect the fruit from pressure. When harvesting tender varieties such protection is essential. Pickers often place the baskets in a tree crotch or hook them over a limb, and then toss the fruit into them from a distance of several feet, causing severe bruises and often broken skins. If the baskets are padded or lined with corrugated paper the fruit is somewhat protected from such injury. The baskets should be fitted with S-shaped hooks to enable pickers to move them frequently and use both hands when picking from ladders.

The correct method of emptying baskets or sacks should repeatedly be impressed on the pickers. Care should be taken not to drop the fruit. When baskets are emptied into lug boxes they should be lowered to the bottom of the boxes and inverted gently, or the boxes should be tipped so that the fruit rolls from the baskets gently down the side of the boxes. Drop-bottom buckets or sacks can be emptied without bruising the fruit if the bottom of the sacks rest on the bottom of the containers when the sacks are opened.

Each of these utensils is peculiarly adapted to certain uses and one can not be recommended to the exclusion of the others. Successful

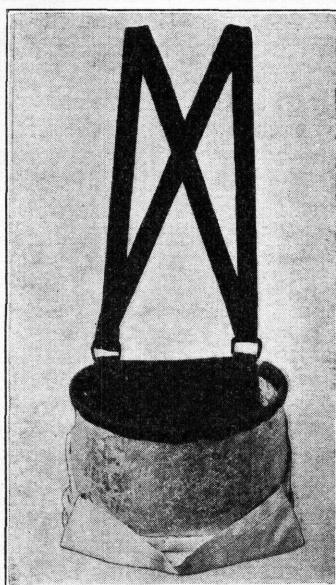


FIGURE 2.—Drop-bottom canvas picking sack. Many growers use homemade burlap sacks holding about three-fourths of a bushel, made easily and quickly from burlap bags with comparatively no expense. Such bags must be inverted to be emptied and this usually causes more apples to be bruised, therefore they are generally recognized as less desirable than the drop-bottom type.

use of any one kind of picking utensil is largely a matter of management, and two types can often be used to advantage.

#### LADDERS

Several types of picking ladders are in common use. The ordinary straight ladder, although still used extensively in most sections, is rapidly being displaced by improved types. Its chief disadvantage is its top-heavy tendency, which makes it difficult to set it securely against small branches without breaking them and knocking off fruit. One desirable modification of this ladder has a broad base and tapers toward the top. This construction gives a better distribution of the weight and makes the ladder correspondingly easier to handle.

The pointed ladder is probably most satisfactory, as it is light and can be placed against a limb or fork that would not support a common straight ladder. For picking in the tops of high trees extension ladders are desirable and make it possible to gather fruit which could not be reached in any other way.

Using such ladders is better than allowing pickers to climb the trees. Climbers in heavy shoes are likely to split the crotches and peel the bark. It is generally necessary to climb for part of the fruit borne in the center of the tree; much injury to the tree through such climbing may be prevented if the pickers wear rubber-soled shoes or leather shoes without heels. When picking fruit from the tops of high trees, time may be saved by lowering filled utensils to the ground with a rope.

Stepladders of various kinds are especially satisfactory in harvesting fruit from small trees and from the lower branches of large trees. The most desirable types are wide and flaring at the bottom, narrow at the top, and supported by but one prop. Such ladders can be "set" quickly and securely, if the ground is level, without knocking off the fruit.

#### BASIS ON WHICH PICKERS ARE PAID

Undoubtedly pickers will work faster if paid on a piecework basis instead of a straight day wage. The piecework basis is advantageous if there is a labor shortage or if low-quality fruit, heavy dropping, or any other circumstance demands quick removal of the crop. Pickers generally make better wages on piecework and any tendency toward carelessness can be avoided by strict supervision. If the grower does not superintend the picking, the damage caused by carelessness may more than offset the advantage of the increased quantity of fruit picked. Work done by each picker can be accurately checked by requiring that a check bearing an identifying number be placed in each basket or box as picked. If the wages are adequate and if the supervision is careful enough, the piecework system can be employed successfully in picking crops of high quality.

#### HANDLING FRUIT FROM TREE TO PACKING TABLE

If fruit is packed at a central packing house or at a permanent location in the orchard, as is done in many commercial orchards, the fruit is delivered to the packing point in boxes, crates, barrels, or baskets. If the crop is packed on tables that are moved from place to place in the orchard the fruit usually is carried to the tables in

baskets or field crates. Crates and boxes are the best containers for moving fruit to the packing shed, as they can be handled conveniently and stacked securely in storage or during hauling, without bruising the fruit.

A durable slatted crate which holds about a bushel is extensively used. (Fig. 3.) The best lug boxes, holding about a bushel, are made of heavy material, with handholes at the ends and cleats across the tops. Providing the pickers at all times with plenty of field crates saves time. In handling and hauling the fruit to the packing shed care to avoid bruising and consequent financial loss is necessary.



FIGURE 3.—Slatted crates holding about a bushel each are extensively used in hauling apples from orchard to packing house

#### GRADING AND PACKING

Grading is separating the fruit into classifications according to the degree of freedom from blemishes or defects, and the amount of color in red or striped varieties. The fruit is sized by machinery in most large commercial packing houses. Where it is done by hand, however, grading and sizing constitute one operation. Grading and packing can be most satisfactorily done in packing houses or under shelter.

The principal containers used for the commercial apple crop in the region east of the Rocky Mountains are the barrel and the straight-sided bushel basket. The bushel basket is also largely used in the Rocky Mountain States. Dessert and early varieties are mostly packed in bushel baskets, while the barrel is largely used for export trade and for some storage varieties. The December 1, 1931, cold-storage holdings showed that, of the apples stored in bushel baskets and barrels, 62 per cent were in baskets and 38 per cent in barrels. For December 1, 1930, the corresponding figures were 61 per cent

and 39 per cent, whereas for the December 1 holdings of the previous 5 years the figures were 39 per cent in baskets and 61 per cent in barrels.

The United States Department of Agriculture official standards for apples as issued in August, 1931, provide for and define the following grades: United States Fancy, United States No. 1, United States Commercial, United States No. 1 Early, United States Utility, United States Utility Early, Combination, United States Hail, and Unclassified.

It is essential that graders thoroughly know the requirements of the grades being packed, and that the grading be carefully supervised. Care is required at all stages of the grading, sizing, and packing processes to avoid unnecessary bruising of the fruit and consequent price discount.

If the fruit is to be held for some time before being packed it should be properly stored, otherwise it should be packed as soon as possible and removed to storage. In producing sections toward the South the common and most desirable practice is to pack the fruit as soon as it is picked and remove it to storage as quickly as possible.

#### GRADING TABLES

Apron-type and canvas or burlap grading or sorting tables are used almost exclusively when fruit is graded in orchards and to some extent in packing houses.

##### APRON TABLE

The apron table or a variation of it is commonly used in all sections. The table shown in Figure 4 is a typical one for packing in the orchard. The bed of this table is slatted so that trash falls through, and inclined so that the fruit as it is graded rolls to the lower end. Here, upon the opening of a stop or trap, it is lowered by means of an apron into the barrel or basket. The end of the table where the packing is done tapers to an opening approximately 1 foot wide. Fruit to be packed is emptied from field boxes or baskets onto the table or into a large bin from which it is fed to the table through a chute. This method may cause unnecessary bruising.

This type of table is popular because work can be done rapidly on it. It is not altogether satisfactory, as the fruit frequently crowds past the sorters and encourages carelessness. The graders must sort out both defective and undersized fruit and the actual sorting takes place as the fruit is pushed or rolled along to the end of the table, which is frequently kept so full that the apples can not be thoroughly inspected.

Where two grades are packed, it is customary to remove the culs and the second-grade fruit into baskets or barrels and allow the first-grade fruit to run over the table. When one of two grades is sorted out the sorters should always remove that grade constituting the smaller proportion of the fruit, in order to reduce handling to a minimum and to allow the grade constituting the larger part of the fruit to be run over the apron into the barrel. The man who packs the barrel is usually responsible for maintaining the grade. He has charge of the crew at his table, and assists in the sorting by going over the fruit as it passes into the barrel.

## CANVAS OR BURLAP TABLE

The second type of grading table is made of canvas or burlap stretched over a 4-cornered frame that is longer than it is wide. Fruit is not run over an apron into the barrel as with the apron table. The apples must be sorted by hand into baskets, in which



FIGURE 4.—Apron grading table in common use. The apples in the corner pockets have been selected for use in facing

they are lowered into the barrels. The advantage of this table is that all apples are carefully inspected as they are removed by the sorters. Although as a rule this is slower than handling the fruit over an apron table, the sorters soon become skilled and fast with practice.

Care is necessary in managing either type of table if the best results are to be obtained. On the apron table the fruit is often bruised by being crowded along with the picking baskets as they are being emptied. Sorters at canvas-topped tables should be cautioned against throwing apples into the baskets into which they are being graded. Such injury may be avoided to a considerable extent by using padded baskets.

#### SIZING AND SIZING MACHINES

Apples are sized both by machines and by hand. Most machines used in barrel and basket packing size the fruit by measurement, whereas the most popular machine used for sizing boxed apples, sizes by weight.

Various sizing practices according to trade requirements are used throughout the barrel-and-basket sections. One common practice is to separate the fruit into size ranges of  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches in diameter and  $2\frac{1}{2}$  inches and larger. The latter range usually includes the greater part of most crops. Some fruit is packed  $2\frac{1}{4}$  inches and larger. Considerable fruit, particularly in baskets, is packed in  $\frac{1}{4}$ -inch size ranges,  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches,  $2\frac{1}{2}$  to  $2\frac{3}{4}$  inches, and  $2\frac{3}{4}$  to 3 inches, or  $2\frac{3}{4}$  inches and larger. Various other size classifications such as  $2\frac{1}{4}$  to  $2\frac{3}{4}$  inches are used to a limited extent. The sizing can be done more rapidly and accurately by the mechanical sizer than by hand, and the use of the machine enables the grower to give more attention to the grading, since the sorters are not concerned with the size. For sizing in  $\frac{1}{4}$ -inch ranges the mechanical sizer is of a value even greater than when apples are divided into only two sizes, since it makes possible a uniformly sized pack with inexperienced help.

The sizing machines used most extensively for barrel and basket packing consist of two principal parts—canvas or roller conveying belts on which the fruit is sorted or graded, and the sizing device proper. The fruit is delivered to the grading belt as it comes from the orchard and is sorted as it moves toward the sizer.

The sizing device of one of the most popular types of machine consists of a series of endless belts composed of rings. (Fig. 5.) The rings in each belt are of a size different from that of the rings in the other belts. Two to four such belts are so arranged that the fruit moves from the one having the smallest rings to that with the largest rings. As the apples are delivered onto these chain belts from the grading belt the smallest drop through the rings of the first and the larger are carried on to the next belt. Where two chain belts are used the fruit too small to be packed drops through the first, which is usually composed of  $2\frac{1}{4}$ -inch rings. The rest of the fruit is carried to the second chain, composed of  $2\frac{1}{2}$ -inch rings, through which all the apples with diameters between  $2\frac{1}{4}$  and  $2\frac{1}{2}$  inches drop. The remaining apples,  $2\frac{1}{2}$  inches or more in diameter, are carried by a short conveying belt to a packing bin equipped with an apron.

The sizing chains are inclined or otherwise arranged so that the position of the apples is changed several times as they are carried over the rings. In varieties with a long shape this is necessary in order to obtain the measurement of the cross diameter, the dimension used

as the basis for all sizing. It is necessary to measure the same diameter of each apple to secure uniformity.

Another popular type of machine is equipped with a series of sizing units, each consisting of an endless, corrugated roller belt having

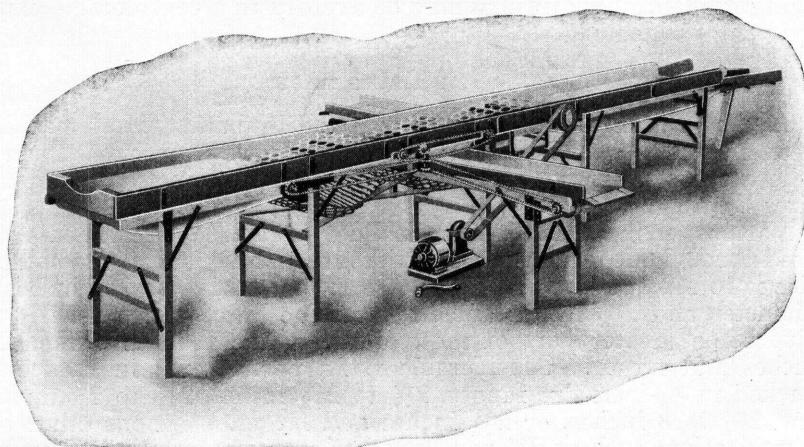


FIGURE 5.—Machine equipped with sizing belts made of linked rings

round openings between the rollers. The sized fruit passes through these openings. (Fig. 6.) The size of the openings in each belt corresponds to the size of the apples that are to be separated by that belt. Fruit of the proper size passes down through the openings in

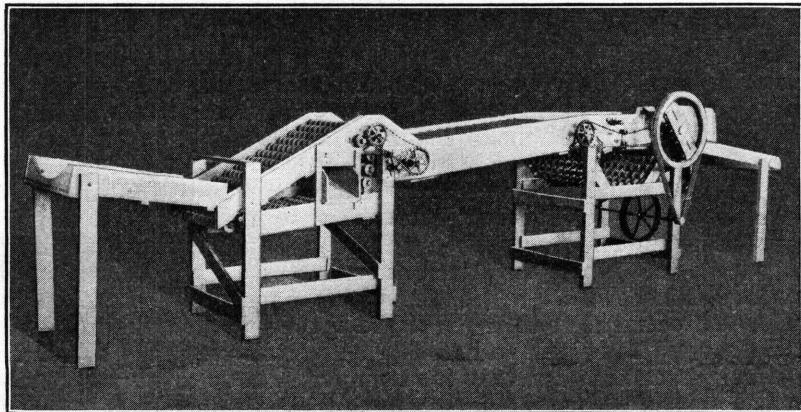


FIGURE 6.—This machine sizes the fruit through round openings in an endless, corrugated roller belt

the belt, while larger apples are carried on to the next belt in the series. Thus the smallest apples are removed first and the largest last. The sizing units are so arranged that the position of the fruit is changed many times as it passes over the rollers, and uniform sizing is obtained.

In another type of machine the fruit is dropped into a series of cups or pockets, operated as an endless belt. (Fig. 7.) These cups or pockets enlarge as the apple is carried along until the diameter is great enough to allow the apple to drop through into the bin. The smaller apples drop through first, and others in order, as the diameter of the cups in which they are carried increases.

In another type of machine the fruit is carried on a belt in a V-shaped trough, and under a series of sizing or ejector wheels revolving on a flexible shaft above. Up-edging brushes suspended over the trough force the fruit to spin rapidly on its cheeks as it moves forward. The spinning motion brings every diameter of the fruit upright as it passes under the ejector wheel so that if the maximum transverse diameter is up to the desired size the fruit will be ejected.

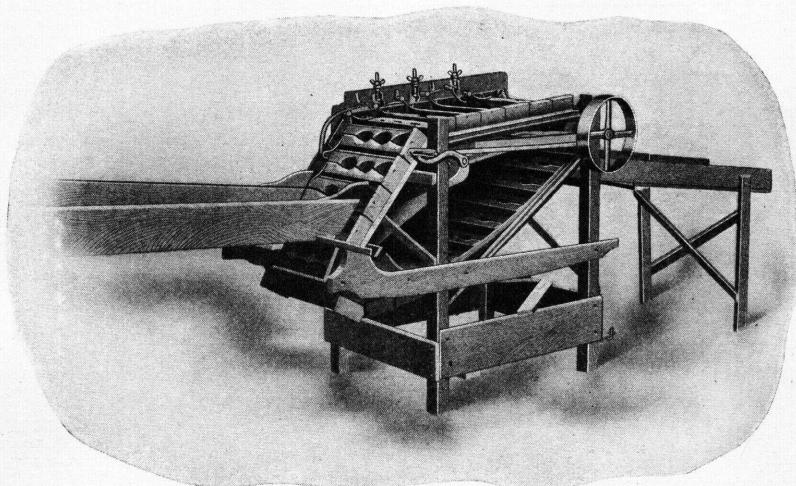


FIGURE 7.—This machine sizes the fruit through cups that enlarge as the belt moves along

A type of sizing machine especially popular in the Western States sizes the fruit according to weight. (Fig. 8.) It is equipped with either a roller sorting section or a canvas belt over which the fruit passes before it reaches the sizing device. Where rollers are used in the sorting section, they are parallel to each other and close together but not in contact. The rollers are wrapped spirally with sash cord so that as they rotate the apples are moved along lengthwise of the rollers and continuously turned so that each apple can be viewed in various positions by the sorters. The apples pass from the sorting section to the sizing mechanism, which consists of an endless chain or belt of small pockets or trays each of which carries an apple as it moves along in a horizontal direction. A tripping device distributes the fruit in bins according to its weight.

In choosing a machine growers should keep in mind that: The machine should have a capacity proportionate to the size of the orchard, so that the operation will be economical; simplicity of design and freedom from too numerous adjustments are much to be desired; durability of the machine is very important since, unless

it is substantially constructed, it will soon go to pieces under the rough handling such equipment generally receives; there must be no arrangements or devices that will unnecessarily bruise the fruit. If the apples are bounced along on unpadded parts, or crowded or congested, there is danger that they will be injured and a machine causing such injury is not suited to handling tender varieties of fruit.

#### ADDITIONAL EQUIPMENT FOR SIZING MACHINES

While many sizing machines now in use are designed to separate only one grade of fruit into its separate sizes, machines that will size more than one grade at a time are now available. By dividing the grading belt lengthwise with a strip or pipe, and rearranging the chutes which divert the fruit from the sizing device to the

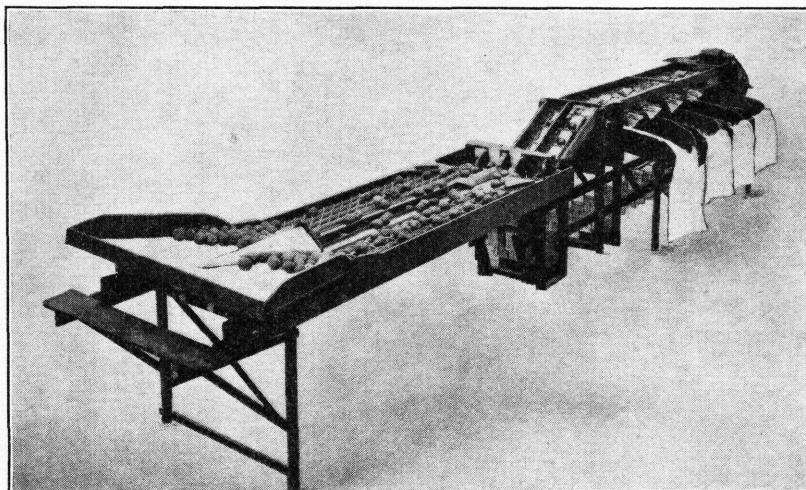


FIGURE 8.—This machine sizes the fruit according to weight. The rollers turn the apples in various positions as they move over the sorting section

packing bins, two grades may be sized at the same time. For example if United States Fancy and United States No. 1 grades are to be sized separately, the field-run fruit is emptied on the belt and passes on both sides of the partition; the culls and the fruit that will not grade United States No. 1 are first removed into containers provided for that purpose, then the sorters standing on the United States Fancy side, without handling the United States Fancy grade fruit, put the United States No. 1 grade across the partition, while the sorters on the United States No. 1 side permit the United States No. 1 grade fruit to pass and put the United States Fancy grade across to the other side. Under this plan only 50 per cent of the fruit is handled, no matter what percentage of the crop falls in each grade, except for such handling as may be necessary to ascertain the grade.

Perhaps a better way of dividing the fruit is to divert it all to one side of the partition, then the grade constituting the smaller part of the crop is sorted out and placed on the opposite side of the par-

tition. This requires handling a smaller percentage of the fruit than the other method, unless the crop is evenly divided between the two grades.

In commercial operations the fruit below the grade of United States Commercial frequently is not separated into various sizes, but all above a certain minimum diameter, usually  $2\frac{1}{4}$  inches, is packed together. Some growers include the United States No. 1 grade of  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inch size along with the Utility grade to make a combination pack of  $2\frac{1}{4}$  inches and larger.

Instead of following the usual practice of sorting out low-grade fruit into baskets or barrels, a belt conveyor 5 or 6 inches wide, placed about 18 inches above the table, may be used to carry the fruit to a side bin at the end of the machine.

Efficient disposal of culls is often neglected and this fruit is allowed to accumulate on the packing floor where it interferes with the operations of the crew. In many houses the culls can conveniently be carried to the basement through canvas chutes. They must be removed later by elevators unless the house is so constructed that it is possible to drive directly into the basement. If there is no basement, conveying belts can be used to carry the culls to elevated bins, from which they can be removed through a trap into wagons.

The method of feeding the fruit to the sizing machine requires careful study because it influences directly the total daily output and consequently the cost of operation. In the first place, it should be possible to supply a continuous flow of fruit to the sizer without crowding or bruising, and in the second place, it should not be necessary to lift the filled containers to any considerable height above the floor to empty them, especially if the loose fruit is hauled in barrels. Unnecessary lifting may be avoided by elevating the receiving platform or floor above the main packing floor, about 30 inches or a little less than the height of the sizing machine, thus permitting the containers to be emptied at about floor level. If this is done the feeding can be facilitated still further by installing a belt, 10 to 15 feet long, on which to empty the fruit. This belt ordinarily should extend along the receiving platform at right angles to the grading belt, so that the loose fruit can be emptied at any point along the line.

Another method of feeding consists of pouring fruit into a hopper on the floor level, from which it is carried to the sorting belt or sizer by means of an elevator belt. This method has been used where the loose fruit is hauled in barrels, and in some houses has given satisfactory results; however, without careful management there is a marked tendency to bruise the fruit. In the first place, the man emptying the barrels may allow them to rest partly upon the fruit in the hopper; then, when the hopper is full the elevating belt frequently carries several apples halfway up the incline between the lugs, and this fruit is generally bruised by rolling back into the hopper. The hopper method is somewhat slower than the use of a belt running on the level of the machine, because the capacity of a feed belt carrying fruit on lugs several inches apart can not be so great as that of a belt running on the level. If a hopper is used, it must be properly padded.

**REMOVING SPRAY RESIDUE**

In most of the region in which apples are packed in barrels and baskets, the rainfall during the growing season is usually sufficient to remove most of the spray residue and it has seldom been necessary to wash or wipe this residue from the apples. However, in unusually dry seasons or if sprays have been applied during the latter part of the growing season, it may be necessary to remove the spray residue. In the far West and in some sections of the East, machines are in general use for washing the apples in a diluted hydrochloric acid solution and then rinsing them in water. The washing usually improves the general appearance of the fruit. Machines that wipe the apples with brushes are also used in some sections, and often improve the appearance of the apples. Persons interested in removing spray residue from fruit should consult Farmers' Bulletin 1687 of the United States Department of Agriculture.

**POWER**

The small machines can be operated by hand power, but in nearly all cases a gasoline engine or an electric motor is preferable.

The speed of the machine needs to be regulated carefully, as the accuracy and care with which the apples are handled are largely dependent upon the speed of the belts and chains. Practically all machines are inaccurate and cause excessive bruising when run too rapidly. When the conveyor belt delivers the fruit to the sizer too rapidly, congestion will result.

**CONVEYORS**

Two principal types of mechanical conveyors are used extensively in packing-house operations—the endless chain or belt operated by machinery for conveying loose fruit or light packages, and the roller type for conveying filled packages by gravity. Chutes can also be used to advantage to convey fruit (especially culls) or packages to a basement or lower floor. The belts are made of heavy canvas or rubber fabric and are made in different widths. A smooth board or rollers serve as a floor over which the loaded part of the belt travels so that it will not sag or fold under the weight of the fruit. Belts or chains fitted with lugs and supported by a trough, are used to elevate or lower the fruit.

The roller conveyors are convenient in moving fruit in packages from place to place on the packing floor or to a lower floor and are especially useful in unloading containers of fruit from the orchard. Fruit can be carried from one point to another within the house more rapidly and with less labor expense by the use of roller or mechanical conveyors than by carrying or trucking it.

**PACKING THE BARREL**

The minimum capacity of the apple barrel has been fixed by an act of Congress at 7,056 cubic inches, or somewhat over 3 bushels. Several kinds of wood, chiefly oak, pine, poplar, and birch, are used in the manufacture of barrels. Barrels are usually coopered with six hoops, but in certain localities growers use eight hoops, four instead

of two quarter hoops. This insures greater strength, as the single quarter hoops are often broken in handling and a barrel without quarter hoops is likely to be badly sprung. Barrels fitted with double quarter hoops can be stacked more solidly on the bilge, as to a certain extent they are prevented from rocking. Some packers use steel quarter hoops with good results.

The barrel is generally delivered to the grower with both heads and all of the hoops in place, but with none secured by nails. This permits the barrels to be stored indefinitely without warping. When the barrel is removed from storage one head is nailed in and liners, which are thin gumwood strips, are tacked over the ends of the pieces that make the head to prevent them from breaking out of the croze. Each quarter hoop is secured by two or three nails on opposite sides of the barrel. The other head is then removed and placed in the bottom of the barrel. Apples packed in new, clean barrels will usually bring a better price than apples packed in secondhand barrels.

#### FACING

The first step in packing a barrel of apples is facing, or arranging the first and perhaps the second layer of apples in concentric rings on the bottom of the barrel. A corrugated cap, a paper cap, and a paper-lace circle, if it is desired, should be placed in the bottom of the barrel. Apples of uniform size and color and fairly representative of the lot should be selected for the face. They may conveniently be placed in a basket which can be lowered into the barrel and emptied on the bottom. The apples are then arranged in rows around the bottom of the barrel, to form the face of the barrel when it is packed. (Fig. 9.) Practically all growers use the single face, consisting of one layer, but the double face is used occasionally, especially for fancy fruit. The apples are usually packed stems down except that the second layer of the double face is often packed on the cheeks. Single faces are often packed up with a layer of spotters, or apples dropped into the spaces between those in the face, so that the colored cheeks turn downward and show through to the best advantage when the barrel is opened. The spotters also keep the apples of the face in place when the rest are poured into the barrel.

The advantages of the single face are twofold. (1) It legitimately increases the attractiveness of the pack and draws the atten-

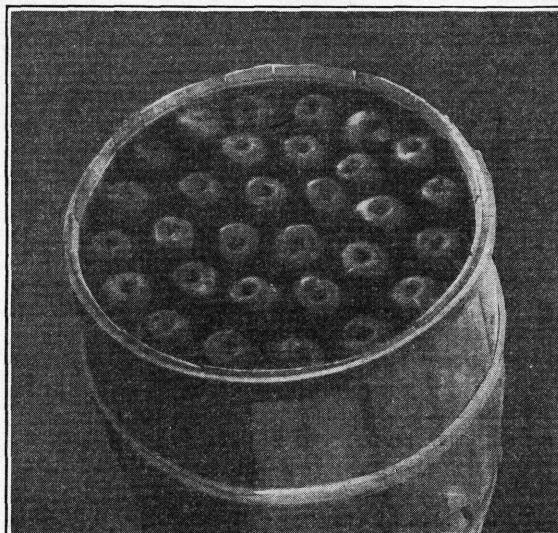


FIGURE 9.—An excellent face made with 2½-inch apples

tion of prospective buyers more readily than if there were no order of arrangement, and (2) if the apples are placed evenly over the surface of the head and are then reinforced by spotters, each one bears an equal amount of the pressure of the head and the bruising is reduced.

The objection to facing is that some packers face with fruit far above the average quality of the barrel in order to deceive the buyer. The United States official packing requirements are that each package shall be so packed that the apples in the shown face shall be reasonably representative of the contents of the package in size, color, and quality.

#### FILLING THE BARREL

After the barrel is faced it is moved to the packing bin or grading table, where it is filled. Two methods of filling are used almost exclusively because they make it possible to lower the fruit into the barrel with a minimum of bruising. Filling is usually done by the aid of a canvas or burlap apron attached to the grading table or packing bin, but it may be done equally well by lowering half-bushel baskets into the barrel and emptying them.

If the slatted-incline table is used, or if a sizing machine sorts the fruit into packing bins, the apron attachment is employed; but if the fruit is emptied from field crates onto canvas-topped tables and is hand sorted into half-bushel baskets, it is emptied directly from these baskets into the barrel. Either method is satisfactory if the packers employ sufficient care.

The use of shredded oiled paper to prevent scald is recommended when packing varieties which are susceptible to this disease and which are intended for storage. The paper should be used at the rate of about  $1\frac{1}{2}$  pounds per barrel, well distributed through the barrel during the packing. For a complete discussion of apple scald and its control, growers should consult Farmers' Bulletin No. 1380 of the United States Department of Agriculture, entitled "Apple Scald and its Control."

A barrel must not only be carefully filled, but packed tightly so that shrinkage and handling in transit or storage will not cause the pack to become slack. To insure a tight pack the apples must be settled thoroughly by racking as they are placed in the barrel.

Racking is the forced settling of the fruit by rocking a partly filled barrel back and forth in a sharp, jerky manner. The racking should be done on a solid floor, preferably concrete. To produce a tight pack the barrel must be racked after the first bushel is poured in upon the face, and again as each half bushel is added, until the barrel is properly filled.

Under no circumstances should a grower omit racking and resort to overfilling to make a tight pack, for no barrel that has been overfilled will pack as tightly as if it had been racked thoroughly to a height nearly level with the top. Pressing an overfilled barrel causes severe bruising all through the pack but does not produce a thorough settling of the fruit. Though apparently tight when pressed, the pack will settle later and become slack. One-half to three-quarters of an inch is usually considered a sufficient height for the contents of a properly packed barrel to extend above the top of the barrel.

## TAILING

Before pressing the head into place it is important to level the apples on the tail so that the pressure will be distributed equally. This is done either by leveling off the high places or by arranging all the exposed apples into a plate formation similar to that of the face. The first practice is known as "jumble tailing" and the latter as "ring tailing." (Fig. 10.) The ring tail is used to increase the attractiveness of the pack and also makes possible a tight pack with less injury from the pressure of the head. It is rather difficult for an inexperienced hand to arrange the ring tail successfully, but a week's practice should enable the average person to ring tail 125 to 150 barrels a day.

Tailing is greatly facilitated by using a "follower" or "shaker," a heavy, circular piece of wood made from 2-inch planks with a handle on top and thickly padded on the underside. It is fitted into the head of the loosely filled barrel and held tightly in place during the racking, causing the fruit to settle with an even surface. The follower is applied to the full barrel if the jumble tail is used, but if the pack is ring tailed it is applied before the barrel is quite full, so that the last layer of apples will bring the contents to the desired height, usually one-half to three-fourths inch above the top of the barrel before heading. The follower expedites both methods of tailing.

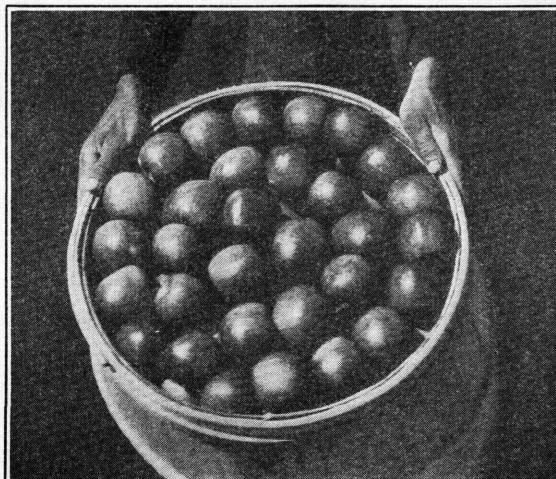


FIGURE 10.—A good example of ring tailing

## PADS

Pads, either corrugated or of the "cushion-head" type, are used by many growers to reduce the bruising caused by pressing the head into place. The cushion-head pad is composed of excelsior covered with paper. If two pads are used one is placed under the face as previously mentioned and the other over the tail; if only one is used it may be placed on either end, but will serve best if placed on the tail end, especially when the apples are jumbled and exposed to the rough and frequently uneven pieces of the head, which cut and bruise the fruit when the pressure is applied.

## BARREL PRESSES

Two types of press are used for heading barrels. One applies pressure by means of a screw and the other by means of a lever. The

screw-type press, (fig. 11) although probably slower than the lever-type press, is greatly superior. It causes less bruising than the lever press because it applies pressure through the screw as a steady force, adjusting the head of the barrel by degrees and without the severe shock caused by the lever press. This difference is important.

Sometimes a platform on which the barrel rests when it is headed is attached to the screw press. When not equipped with such a platform the press hooks onto the bottom of the barrel by means of iron strips that extend down each side. This arrangement is likely to break the bottom

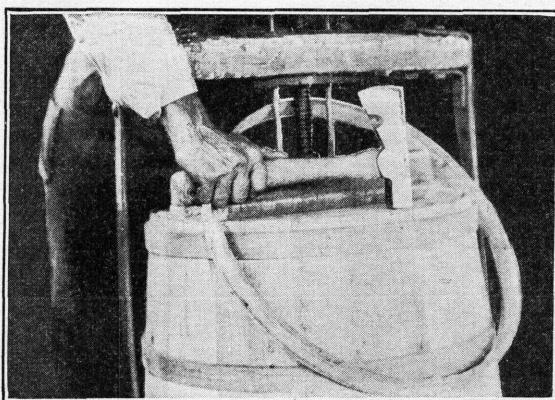


FIGURE 11.—The screw press used for heading barrels

hoops as the head is pulled into place, especially if the barrels are old or damp.

#### NAILING

When the head has been pressed into place and the upper hoops have been tightened the barrel is ready to be nailed. The nails should not be so large as to split the headpieces and should be driven through the top hoops at an angle of about 45°. Nails driven horizontally into the ends of the headpieces frequently split the wood and do not hold as securely as when driven at an angle. From six to eight nails will hold the 3 and 4 piece heads in place. The use of more is a waste. Many growers use head liners to give additional strength to the pack. This is advisable, especially if barrels are to be transported long distances. The liners are strips of wood nailed over the ends of the headpieces. (Fig. 12.) They tend to prevent the head from springing out of the croze when the pack is submitted to a severe strain.

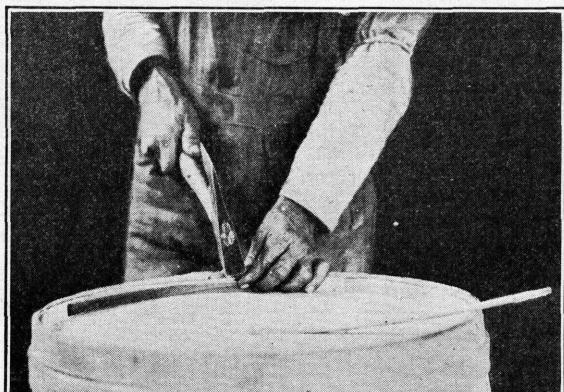


FIGURE 12.—Nailing on the head liners

#### PACKING THE BUSHEL BASKET

Two general types of bushel baskets (fig. 13) are used as containers for apples: The straight-side type commonly known as the bushel

tub; the old-style, round-bottom type. The straight-side baskets are of several different kinds including the continuous stave, the raised bottom, and the loose or removable bottom type.

The straight-side basket is used more than the round-bottom type because it is stronger, gives better protection to the fruit and stacks better in storage or shipment. The straight-side basket with a raised

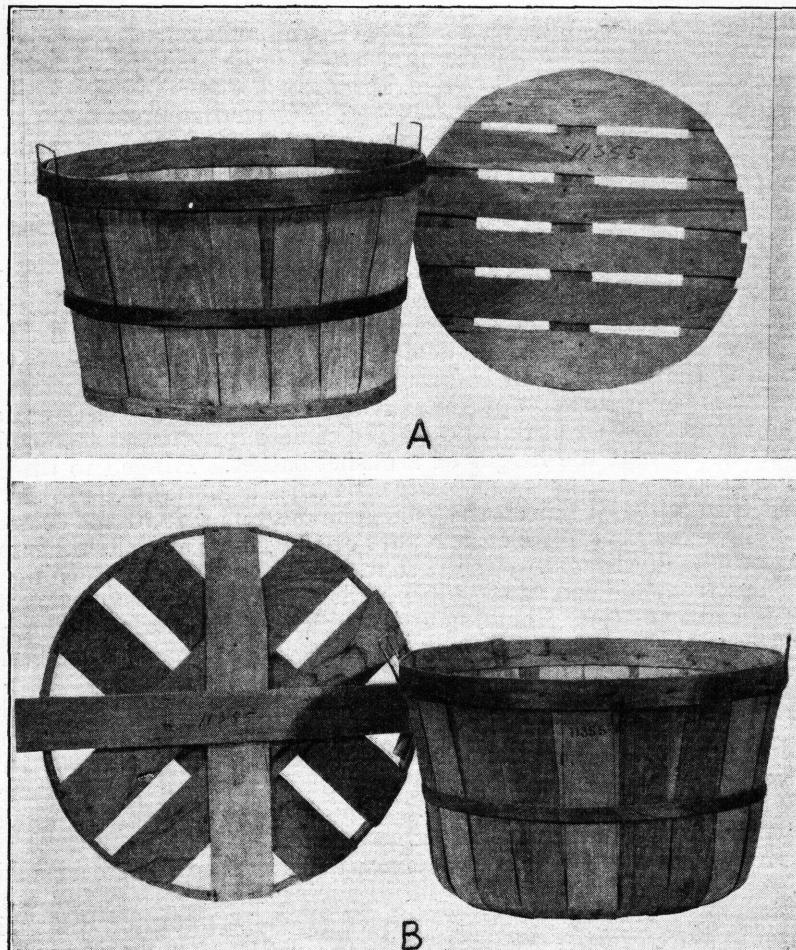


FIGURE 13.—Two general types of bushel baskets are used as containers for apples:  
A, The straight-side type; B, the round-bottom type

bottom, which tends to prevent bruising, has been found the most satisfactory type of basket for export shipments. The old-style round-bottom type has been found unsuitable for export shipments. Even for short-distance shipments growers will usually find it to their advantage to use strong, well-constructed baskets that afford ample protection to the fruit. The wire handles should be firmly clinched to prevent their puncturing the fruit.

## DEVICES AND METHODS OF PACKING BASKETS

Several devices for packing bushel baskets are on the market. With these devices the pack is made in an inverted position. One type of device includes a light, slightly concave, metal facing form. On this form the facing apples are laid in concentric circles, each apple having its stem end or its cheek next the form so that it will be on top when the basket is set upright. A light metal form or shell having the shape and size of a bushel basket, with a heavy paper liner inside it, is placed on the facing form and filled. It is a good practice to place the second layer of apples in the openings between the facing apples to support the face and improve the appearance of the pack. The remainder of the apples are then poured in carefully. The form is racked on a firm base sufficiently during the filling process to insure a tight pack. A canvas or burlap apron attached to the bin helps to prevent bruising the apples as they are poured into the form.

The paper liner holds the pack in place when the packing shell is removed. The basket is then slipped down over the pack and basket and facing form are held firmly together while the pack is turned right side up. Mechanical devices are sometimes used to assist in holding the facing form and the contents tightly in place while the basket is being turned upright. One such device consists essentially of a round crossbar at the middle of a table, supported at each end by posts about half the height of a bushel basket. Hinged to this bar by eyes are two frames each of two parallel L-shaped rods so shaped that they will rest flat on the table, one on each side of the crossbar. The inverted pack rests on one part of the frame and the other part is brought down against the bottom of the basket. By turning the frames from one end of the table to the other the pack is brought to an upright position. The facing form is then removed, a facing pad or corrugated cap is put in place, and the lid is placed on the basket. (Fig. 14.)

Under a slightly different system of packing the face is laid in the basket cover instead of in the facing form. A filling shell and a liner are used. A press which holds the basket and cover firmly together in the inverted position facilitates the proper fastening of the cover with four flat hooks. The basket is not turned upright until the cover has been securely fastened. (Fig. 15.)

In another type of packing device there is a spring-steel packing form with flat fingers, and a metal facing form with a felt center which fits inside the packing form. (Fig. 16.) After the facing form is placed inside the packing form the face is laid and the form is filled with apples. The basket is then placed over the form, and basket and form are set upright. The packing form is then removed while the facing form is held in place with the foot, to prevent disarranging the face. The facing form is then lifted off and the cover is attached. The heavy paper liner is not necessary when this method is used.

One type of basket has a removable bottom. In packing, the cover is first fastened in position, the basket inverted, and the bottom removed. After the face is arranged on the cover, the basket is filled and the bottom fastened firmly in position with five wire loops. (Fig. 17.)

In a well-packed basket the facing layer should be slightly convex and should protrude sufficiently to hold the cover firmly in position and prevent the face from becoming disarranged. Corrugated or cushion-type caps are frequently used under the cover and cor-

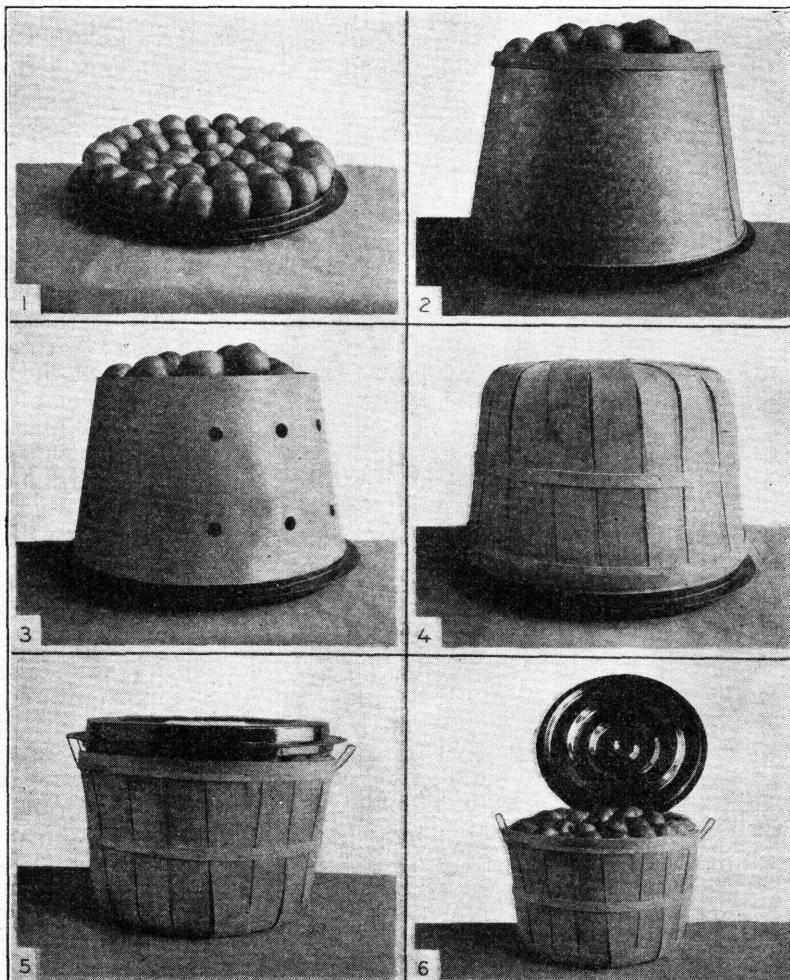


FIGURE 14.—Six steps illustrate this method of packing bushel baskets: (1) The face of the pack is laid in the facing form; (2) the metal packing shell with heavy paper liner inside is placed on the facing form and filled; (3) the packing shell is removed and the pack is held in shape by the liner; (4) the basket is placed over the pack; (5) the basket and facing form are held firmly together and the pack is turned upright; (6) the facing form is removed and the packed basket is ready to have the cover attached.

ruggated pads in the bottom of the basket. (Fig. 18.) The cover should be fastened on securely. Frequently it is held by inserting the projecting cover strips under the wire handles on either side of the basket. Pliable wire hooks midway between the handles are generally used to help hold the cover. In some types of baskets the

cover is fastened with four or five special hooks instead of by inserting a cover strip under the wire handles.

When baskets are packed in the upright position, they should be well shaken or racked when about half full, to insure a substantial pack. When the basket is filled (except for the facing layer) it should be shaken and a slightly concave follower used in putting the apples in proper shape to receive the facing layer. When the basket is packed, its contents should be high enough to hold the cover tightly in place.

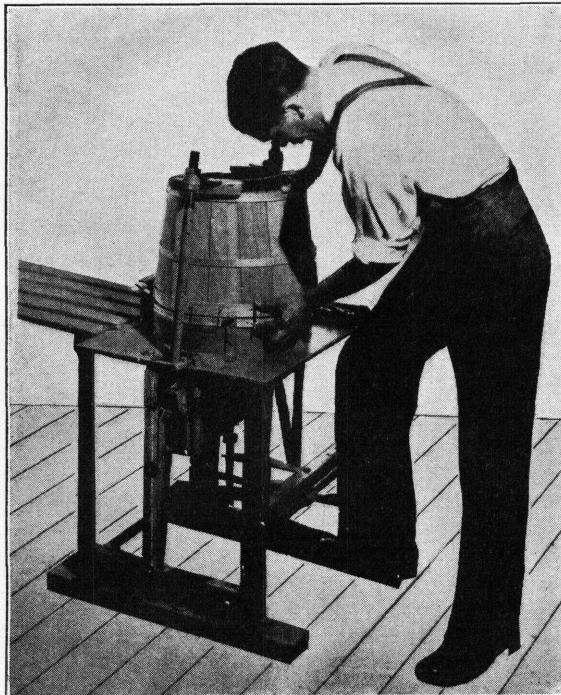


FIGURE 15.—Under this method the basket and cover are held firmly together in the inverted position by a press, while the flat hooks which hold the cover on are attached.

A solid ring pack is used by a few growers for high-quality apples of certain varieties. Under this system the apples are arranged in concentric circles, layer upon layer, until the basket is completely filled. In packing fruit of poor quality, growers have sometimes used the jumble pack without facing.

In packing storage or late-season varieties which are susceptible to scald it is important to use shredded oiled paper, at the rate of about one-half pound per basket, well distributed through the pack, to prevent this disease.

#### MARKING THE CONTAINERS

The barrels or baskets should be plainly marked to show the variety, grade, and size of the apples. The name and address of the grower or shipper are frequently shown also. The marking is usually stenciled on the head of the barrel or the top of the basket. Most States have laws governing marking.

#### PACKING HOUSES

Most commercial orchardists use packing houses equipped with machinery for grading and packing apples. In small orchards, under favorable weather conditions, apples are often packed in the open with portable equipment, but even small growers find it generally more satisfactory to pack in a house or shed. Even on rough

and hilly land where it is difficult to haul the unpacked fruit, packing in houses has proven more satisfactory than packing in the open. In a packing house any accumulation of unpacked fruit is sheltered, and grading and packing can be continued without interruption in spite of unfavorable weather; equipment, packages, and fruit are protected from the weather at all times; use of a house encourages the installation of sizing machinery and other labor-saving devices which can not be used to advantage in the open; and efficient organization of labor is simplified by having all of the work done in one place and avoiding the unnecessary confusion and loss of time caused by moving the outfit frequently.

Community packing houses operating cooperatively or as private enterprises are used in some producing districts. Their use is conducive to a uniformity in grade and pack of apples shipped from the district that is desirable from a marketing viewpoint. Economies in operation and lower costs per package for grading, sizing, and packing are often possible in community packing houses because of the large volume, good machinery and equipment, and well-trained and supervised help. Improved roads and the concentration of commercial orchards in limited areas favor the success of community packing houses.

Many types of structures, ranging from tents and sheds to permanent buildings equipped with packing machinery, are used in apple packing. The most desirable type is determined largely by the size of the orchard and the section in which it is located. In many places where individual orchards are too small to justify the erection of modern packing establishments, such houses have been built and successfully operated as community enterprises.

Packing houses can best be classified according to their equipment. Those with no labor-saving devices other than those used to fill and head the barrels are in one class; those equipped with sizing machines,

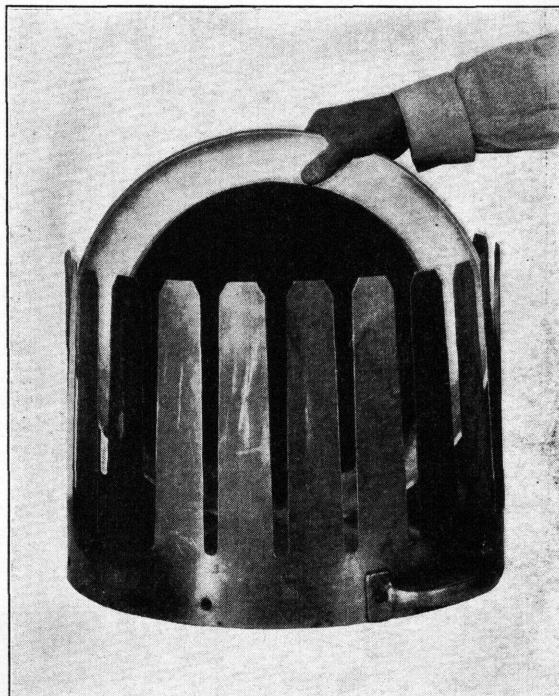


FIGURE 16.—In this packing device the face is laid on the facing form with felt center after the form has been placed in the packing shell. The face of the pack is held in position by the facing form while the packing shell with the flexible steel fingers is being withdrawn from the basket

gravity and belt conveyors, and other mechanical devices, constitute another class, regardless of the extent of floor space or the construction of the building in either case.

#### LOCATION



FIGURE 17.—The bottom of this basket is removable and is fastened in position after the basket is packed

In choosing the site for a packing house several points are important. A community house, practically without exception, should be located on a railroad to avoid the added expense of hauling the packed fruit to the railroad.

If the packing house is located at the orchard, its position depends largely upon the lay of the land. If the land is generally level it is sometimes better to have the house in the middle of the orchard, thus reducing to a minimum the aggregate distance for hauling the unpacked fruit. When the road to the shipping station is good and permits hauling heavier loads than can be pulled through the or-

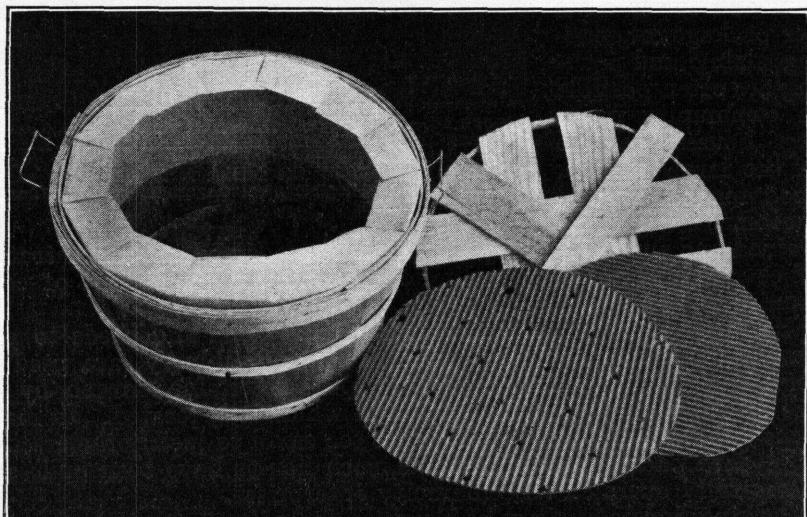


FIGURE 18.—Straight-side bushel basket with cover, corrugated pads for top and bottom, and liner of the type extending part way down the side of the basket and overlapping on the face of the pack

chard, the house should be placed on this road. In a hilly orchard the house should be located where there is a minimum of uphill hauling.

If basement storage is desirable, advantage can sometimes be taken of a slope to build a house having the receiving platform level with the wagon beds on the upper side and the floor of the basement level with the wagon road on the lower side. Under this arrangement the fruit can be conveyed to the basement by gravity and removed without elevators.



FIGURE 19.—In this packing house there is adequate light. A roller conveyor is used to move the filled barrels from the packing bins

#### LIGHTING

In constructing a house or remodeling an outbuilding for use as a packing plant, providing for an abundance of light is of first importance, for the thoroughness of the work is severely impaired if the fruit is partly in shadow. Skylights and windows high up on the walls in sufficient number to light the interior thoroughly offer the most satisfactory lighting arrangement. (Fig. 19.) If there is a loft, skylights can not be used except by adding light shafts. The sides of the shafts should be painted white to increase the illumination of the packing shed. A large house that depends upon side illumination is likely to have a dark area near its center, even though the sides may be entirely open, but if all tables and

conveyor belts used for sorting are placed along the sides of the house the light will fall directly on them.

If artificial illumination is used at any time, special care should be taken to arrange the lights for the sorting operations so that there will be no shadows on the fruit. For this purpose reflectors consisting of inverted troughs fitted with electric bulbs can be suspended over the grading belts or tables.

#### STORAGE ACCOMMODATIONS

Every packing house should have adequate space for storing empty packages, for temporary storage of loose fruit from the orchard, and for packed fruit intended for cold storage or shipment.

If 50 per cent or more of the packages needed for the crop can be stored in the house at one time, there is little danger of shortage and consequent necessity to suspend operations during the height of the season, as frequently happens when it is planned to obtain the packages from day to day from a local cooperage.

A loft or second story immediately over the packing floor is sometimes used as a storage for empty barrels or baskets but makes it difficult to supply adequate light in the packing room. A shed adjacent to the packing shed is perhaps the most satisfactory place for storing empty containers. If barrels are stored on the packing floor, the house must be unusually large to accommodate them without congestion and confusion.

A wide receiving platform or the floor space adjacent to the feeding belt should be used for storing enough field-run fruit to supply the crew for several hours or longer, so that temporary interruptions in the delivery of fruit from the orchard will not interrupt packing operations.

It is also well to provide room for at least one day's output of packed fruit awaiting movement. A shortage of cars or of hauling facilities frequently prevents removing the fruit as rapidly as it is packed; space should be provided to accommodate such fruit temporarily without hindering the packing operations. Such space can be provided satisfactorily in a basement, particularly if the shed is built on sloping land, so that the packed fruit can be loaded on trucks from the basement level.

#### VENTILATION

Adequate ventilation throughout all parts of the house, especially those parts intended for temporary storage of fruit, is important. The main packing room seldom lacks ventilation because of the number of windows required for proper lighting.

#### SUGGESTED FLOOR PLANS

It is impossible to give here the exact specifications for building packing houses, but with the aid of several suggested floor plans certain desirable features of construction and arrangement for the convenient and economical handling of fruit may be pointed out. In planning the construction of any packing house the space near the sorting and packing operations should be kept as free as possible from supporting timbers.

The type of house suggested in plan 1 is designed for packing by hand over ordinary apron or canvas-top tables. (Fig. 20.)

The dimensions of this house are 30 by 60 feet, which, with a double-apron table, should provide for an output of 200 barrels per day. For larger operations the floor space and the number of units can be increased indefinitely. The house is divided into two sections, one to be inclosed for storing empty barrels or baskets and the other to be left open on two sides for packing. The space available for packing operations is increased by adding two covered platforms 5 feet wide, extending along the open sides of the packing room. The driveways should be built so that the truck or wagon beds will be level with these platforms to facilitate loading and unloading. The

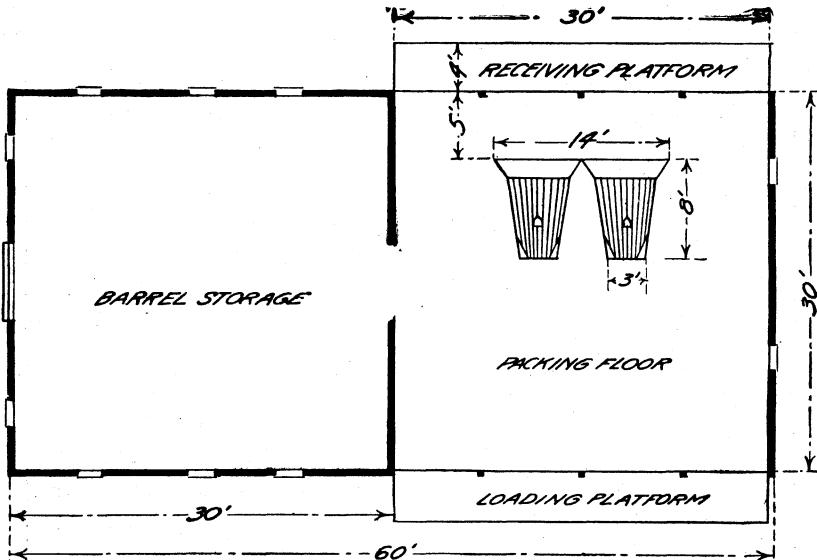


FIGURE 20.—Plan 1: Floor plan of a packing house designed for packing by hand

fruit is received on one platform and passes through the packing operations to the other side of the house, where it is loaded on trucks. The equipment is so arranged that the work can be done without waste motion. Extra space in the packing room is provided for unpacked and packed fruit.

Plan 2 shows a house equipped with three grading machines which have a total capacity of approximately 1,200 barrels a day. (Fig. 21.) This arrangement is particularly well adapted to a community house in which fruit is packed for a number of growers. The feeding belts marked A are very desirable, making it possible to empty fruit on the machine from practically any point along the receiving platform. The fruit passes over the sizing chain B, where any apples smaller than the minimum size for packing are dropped into a cull chute C leading to the basement. The remainder of the fruit is then delivered to the grading belt D, where the badly defective apples are culled out by the sorters and dropped into another branch of the cull chute. The grading belt may be divided as illustrated

in the center machine so that two grades can be sized simultaneously. In this case the sorters who work on both sides of the grading belt divide the fruit into two grades, which may be United States Fancy and United States No. 1, and which are placed on opposite sides of the division board E. Usually the fruit from  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches in diameter passes through the rings marked F into the bins G and GG. But the fruit  $2\frac{1}{2}$  inches in diameter and larger is carried up the elevator belt H onto another belt I, which delivers the Fancy fruit into bin J and the United States No. 1 fruit into the double bin K. This bin is fitted with a gate or deflector L, which when open fills the first compartment and when closed allows the second compartment to fill. Two bins are provided for this

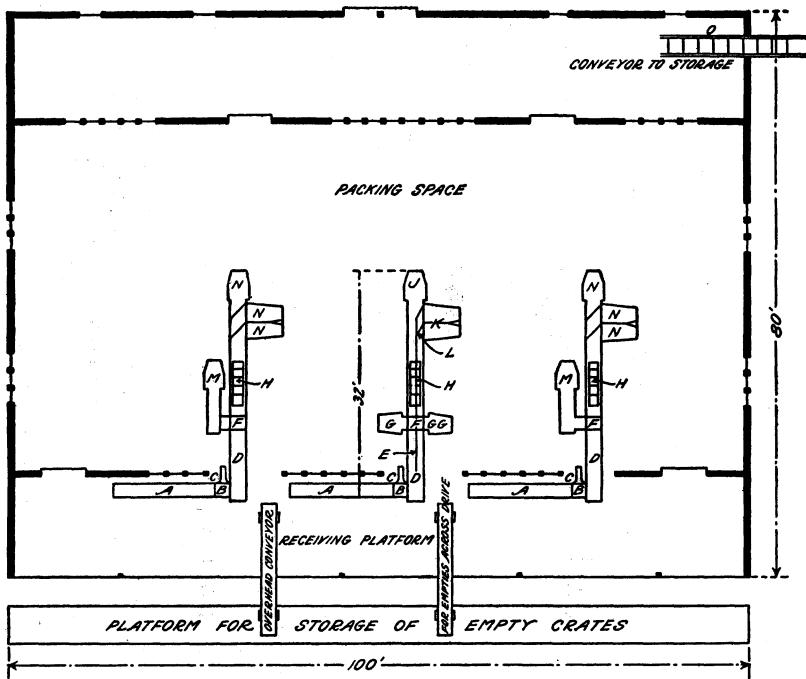


FIGURE 21.—Plan 2: Floor plan of a community packing house with a capacity of 1,200 barrels a day

fruit because the bulk of the average crop grades United States No. 1,  $2\frac{1}{2}$  inches and larger, and there must be bin space enough to accommodate all this grade when operating the machine continuously. If a third grade such as United States Utility, is to be packed, this grade would have to be picked off the sorting belt into baskets or placed on a special conveyor belt.

The end machines indicated in this plan are not equipped to size two grades. Fruit of quality other than United States No. 1 is removed from the sorting belt into baskets and packed in the space behind the sorter, while the United States No. 1 fruit from  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches in diameter passes through the sizing chains F and is conveyed into bins M. The bulk of the crop, which is United States

No. 1 grade,  $2\frac{1}{2}$  inches and larger, is distributed among the three bins N. If United States Commercial or other grades are to be packed, it may be necessary to vary the sorting and sizing operation accordingly.

After the containers are packed they are passed to the platform in the rear of the house, and from there may be transferred by means of the conveyor O to storage or loaded on trucks or cars. This house is equipped with two overhead conveyor belts for carrying empty crates across the drive from the main packing floor to the platform for storage of empty crates. This arrangement keeps the whole area of the receiving platform always available for incoming fruit.

A loft may extend over the whole packing floor for barrel and basket storage, if adequate light shafts are provided. The containers may be coopered and stenciled here and lowered through shafts to convenient points on the packing floor. (Fig. 22.)

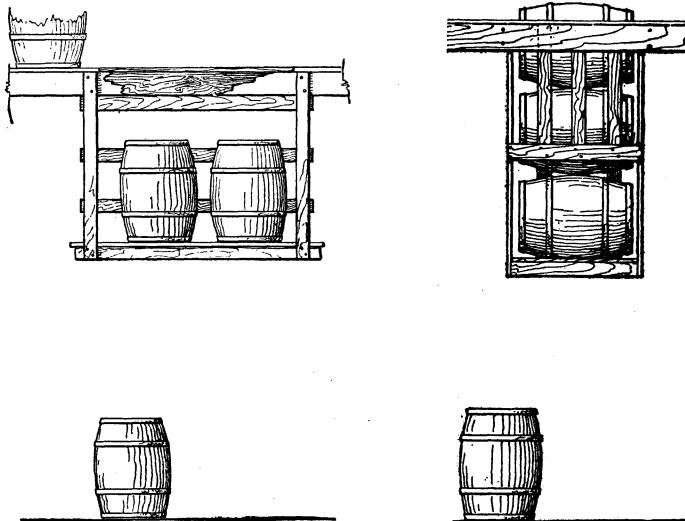


FIGURE 22.—Two desirable methods of lowering empty barrels from loft to packing floor

Plan 3 shows a house equipped with two grading machines having a total capacity of 1,000 barrels a day. (Fig. 23.) The fruit is delivered on a receiving platform which extends the total length of the house. It is emptied from the orchard containers onto the conveyor belt A at any point along the platform. This conveyor belt is built 8 inches above the receiving platform, which greatly facilitates the emptying of the crates. The receiving platform B is 48 inches above the level of the packing floor. The sorters, indicated by  $\times$  in the diagram, work on the platform C, which is elevated 18 inches. The sizing belts are 56 inches above the packing floor, which makes it possible to deliver the fruit directly from the sizing chains into the packing bins by gravity. As the fruit passes over the first sizing rings at D all the apples under the minimum size for packing

drop into a chute which delivers them into a pile outside the building. The packing bins F, G, H, and I are used for various sizes of fruit.

Apples of the various sizes selected for facing are carried to facing bins J. The container storage should be located in a loft over the packing floor where the barrels are coopered and placed in racks L, from which they are removed by the persons doing the facing. Packed containers awaiting shipment may be stored temporarily on the covered platform M.

Plan 4 embodies many features of a conveniently arranged packing house. (Fig. 24.) The over-all dimensions of the house are 40

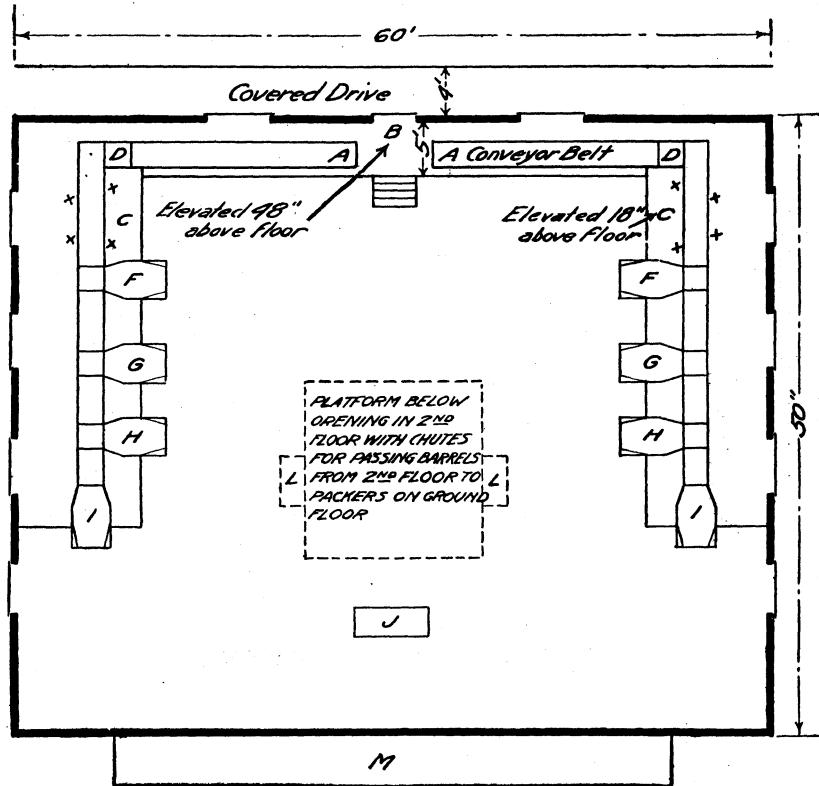


FIGURE 23.—Plan 3: Floor plan of a well-arranged house capable of handling 1,000 barrels daily

by 50 feet, with a total capacity of approximately 500 barrels per day. These dimensions can be changed to provide a larger space for the storage of unpacked and packed fruit. The actual floor space occupied by the packing machinery is 20 by 30 feet. Empty containers are stored in a large loft over the packing floor. Barrels are coopered in the loft and as needed are let down through the shafts A. This arrangement avoids accumulation of empty containers on the floor of the packing house to interfere with the operations of the crew.

The fruit-receiving floor is 30 inches above the rest of the floor. The receiving space is enlarged by the addition of a 4-foot outside

platform extending the width of the house. The feed belt B, 18 feet long and 2 feet wide, is 18 inches above the receiving floor. The feed belts of some grading machines are approximately  $3\frac{1}{2}$  feet above the floor, but it is impracticable to empty barrels on a belt at this height. The fruit passes from the feed belt to the first sizing rings, where all fruit smaller than  $2\frac{1}{4}$  inches is graded out. The larger fruit passes to a grading belt C, which is 7 feet long and accommodates six sorters. This belt is divided by a partition, so that as the fruit passes, the Utility grade is sorted out and diverted into the first bin. The culls are thrown into two chutes E leading to the bin outside the house. The United States No. 1 grade fruit passes to the

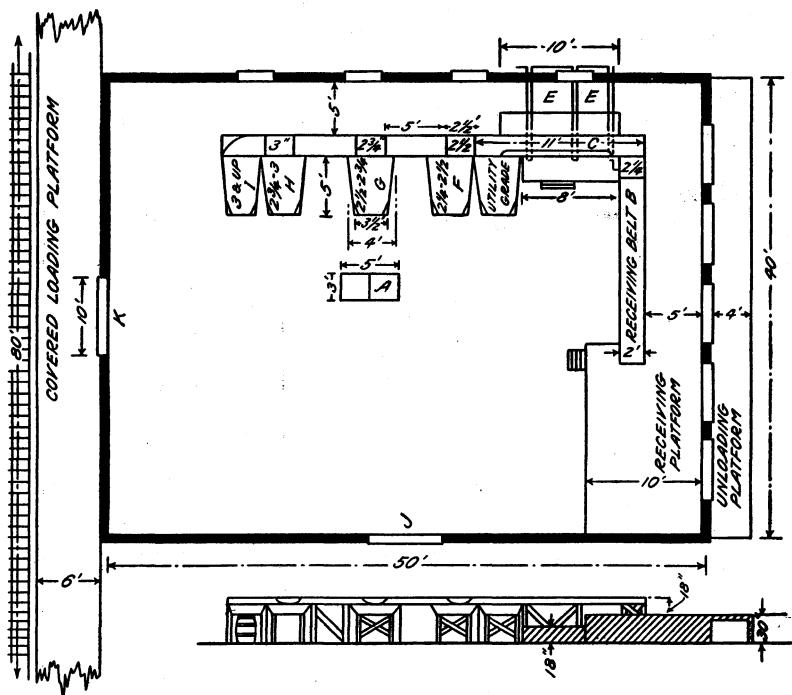


FIGURE 24—Plan 4: Floor plan of house fully equipped for barrel and basket packing

next sizing rings, where the fruit  $2\frac{1}{4}$  to  $2\frac{1}{2}$  inches in diameter is dropped into bin F. The remainder of the fruit is separated according to size into bins G, H, and I. Sorters stand on a raised platform 18 inches above the floor level. The sizing belts are 48 inches above the floor, high enough to provide the proper drop to the packing bin. The fruit is loaded on the cars from a covered platform 6 feet wide and 80 feet long.

At the receiving end of the house there are doors hinged at the top to swing outward and upward. When open, these doors form a cover for the platform and leave the receiving floor free from obstruction. There are also sliding doors at J on the side of the house and at K in the rear. Windows in the sides of the house, together with the doors, furnish light for the packing operations.

### HAULING

Since much of the apple crop marketed in barrels and baskets is packed at the orchards, it is usually necessary to haul the packed fruit to the shipping point, sometimes several miles away. This hauling must be done as rapidly and cheaply as possible and with a minimum of damage from shaking the pack and bruising the fruit. Careful handling of the packed fruit is as important as care in any of the packing operations. Damage caused by bruising results in price discounts on the markets. A rough, jolting haul frequently impairs the rigidity of the package so much that it will not withstand the strain of transit.



FIGURE 25.—A satisfactory and widely used method of loading barrels

Motor trucks are best suited for such hauling because they combine speed, large capacity, and smooth carriage. Trucks can be fitted with racks which make it possible to haul larger loads than are possible in the truck beds.

### LOADING IN CARS

A good system of loading in cars must provide for the even distribution of the strain on the barrels or baskets, and these containers must be stacked tightly enough to avoid shifting and breaking. The most popular and probably the most satisfactory method of loading barrels is known as the alternating-straight load. (Fig. 25.) This load is started by placing two rows of three barrels each, end to end, across the car, which leaves a space of about half the length of a barrel at the end of the rows. The second layer is then started by placing a row of three barrels on top of the first two rows, but start-

ing from the opposite side of the car and covering the open space between the ends of the rows below and the side of the car.

The remainder of the car is loaded in the same way, alternate layers being started from opposite sides of the car. By this method long channels are formed along the walls lengthwise of the car and serve as flues for the circulation of air. When cars are shipped under refrigeration a load stacked in this way cools more quickly, and if a ventilated car is used there is a free circulation of air throughout the car. An additional advantage is that the bilge of one barrel does not rest directly upon the bilge of another, but in the hollow space over the ends of four barrels below. In some instances the barrels are loaded irregularly between the doorways for convenience in loading; sometimes they are stood on end.

In loading a car with bushel baskets, perhaps the most common and satisfactory method is to begin by placing a row of baskets the entire length of the car. Baskets should be placed so that the top hoops are in tight contact with each other and the handles should be placed diagonally to the side of the car. (Fig. 26.) The second layer is placed on the first so that the baskets in the second layer are

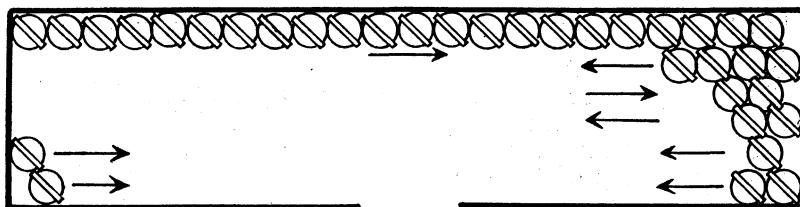


FIGURE 26.—Floor plan of car, showing a good method of loading apples packed in baskets. The arrows indicate the direction from which the rows (usually four baskets high) are stowed. The handles are placed uniformly diagonally to the side of the car.

not centered directly on top of the baskets in the lower layer, but each rests on two baskets in the lower layer. Except for early-season shipments it is customary to load the cars four layers high. The first row, four layers high the entire length of the car, is usually loaded before the second row is started. Each basket in the second row, which is started from the other end of the car, fits against two baskets in the first row. This process is continued until the car is loaded. The last two rows in the car are usually built up together, beginning at the ends of the car and working toward the door. In a 33-foot car, 22 baskets can be loaded lengthwise, with 6 baskets across the car, and 4 layers high, making a load of 528 baskets.

#### COLD STORAGE

In order that apples shall reach the market in the best condition, those not intended for immediate marketing should be placed in cold storage as soon as possible after they are packed. If the fruit is allowed to remain for some time at a rather high temperature it will become mealy and will lose in market value much sooner than does fruit placed in cold storage immediately. This is particularly true of some of the more tender varieties. The ideal range of temperature for storage of most varieties is about 30° to 32° F., and this range can

not be maintained in common storage. Cold-storage facilities for a large part of the crop are available in many of the important producing areas. The large markets are also well provided with these facilities.

#### GRADING LAWS AND INSPECTION

As far as the Federal Government is concerned the use of the United States grading standards is optional with growers and shippers. Tentative United States grades for apples were first recommended in 1918. In 1924, they were promulgated by the Secretary of Agriculture to be the official standards of the United States for the inspection and certification of barreled apples. Since that time the standards have been revised from time to time in accordance with the requirements of the industry.

The United States standards are in general use in the region east of the Rocky Mountains. At the beginning of 1932, 15 States had compulsory grading laws based on either Federal or State standards. Only one of these States, however, provided for compulsory inspection of all apples for shipment.

Inspection of apple shipments by Federal-State inspectors is available for a small fee in most of the important apple-shipping districts. Certificates giving a statement of the grade and a description of the shipment are furnished to the interested parties as a part of the service. For the year ended June 30, 1931, 24,287 cars were inspected under the Federal-State service at shipping points in the region that ships mostly barrel and basket apples. This represents about 47 per cent of the car-lot apple shipments from this region. The Federal inspection service is also available in the important markets; here for a small fee inspection can be had upon request by financially interested parties.

The use of the United States grades and the inspection service furnishes a basis for sale to distant buyers and for contract transactions and discourages the rejection of cars without just cause upon arrival at the market. A record of grade, together with a description of the shipment, including variety and size of fruit, such as is furnished by an official inspection certificate, facilitates settlement of any claims against transportation companies. Grading and inspection of apples under the United States standards encourage improvement and uniformity in grade and pack, which is beneficial to the industry.